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# ENHANCING CAPACITY FOR LOW EMISSION DEVELOPMENT STRATEGIES (EC-LEDS) CLEAN ENERGY PROGRAM

Cooperative Agreement No. 114-A-13-00008

## Industry Sector Overview



# Enhancing Capacity for low Emission Development Strategies (EC-LEDS)/ Clean Energy Program

## Industry Sector Overview

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### Disclaimer

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government

This report was developed as one of the components of the technical support provided by the “Enhancing Capacity for Low Emission Development Strategies (EC-LEDS)/Clean Energy Program” to the Government of Georgia in the process of preparation of the Low Emission Development Strategy. The main objective of the report is to analyze the energy consumption and emissions from the industry sector, assess the most energy-intensive industrial enterprises and identify the barriers for implementation of energy efficient measures in the industry sector of Georgia. The barriers and conclusions identified in the report will be the basis for elaboration of the Low Emissions Development Strategy and measures planned in the Strategy.

The report is prepared by Anna Sikharulidze from “Sustainable Development Centre - Remissia”. The expert of the project, Nodar Kevkhishvili conducted the interviews with industrial enterprises.

The project expresses its sincere gratitude to the Ministry of Economic and Sustainable Development of Georgia for acting as a mediator between project and the industrial plants for conducting interviews.

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# 1 Introduction

The industry sector plays an important role in the development of country's economy. In the sectoral composition of the Gross Domestic Product (GDP) of Georgia, the industry has the second biggest share with 16.9% (the trade sector is in the first place with 17.5% share). The share of the construction sector is 7.1%. In 2014 166.6 individuals were employed, the goods of 8 201.5 million GEL were produced and the main assets with the value of 6 097.6 GEL were held by the industry sector.

The energy balance of Georgia covers the energy consumption of the following sub-sectors of the industry:

- Chemical and petrochemical
- Iron and steel
- Food, beverages and tobacco
- Non-metallic minerals
- Transport equipment
- Machinery
- Mining and quarrying
- Paper, pulp and printing
- Wood and wood products
- Textiles and leather
- Not elsewhere specified industry.

In addition, the energy balance accounts for energy consumption by construction sector under industry sector.

According to the data of the National Statistics Office of Georgia, 6 684 industrial enterprises were registered in 2015<sup>1</sup>, out of which 536 were large, 661 – medium and 5 487 small enterprises.<sup>2</sup> The largest number of industrial enterprises is registered under food, beverages and tobacco sub-sector.

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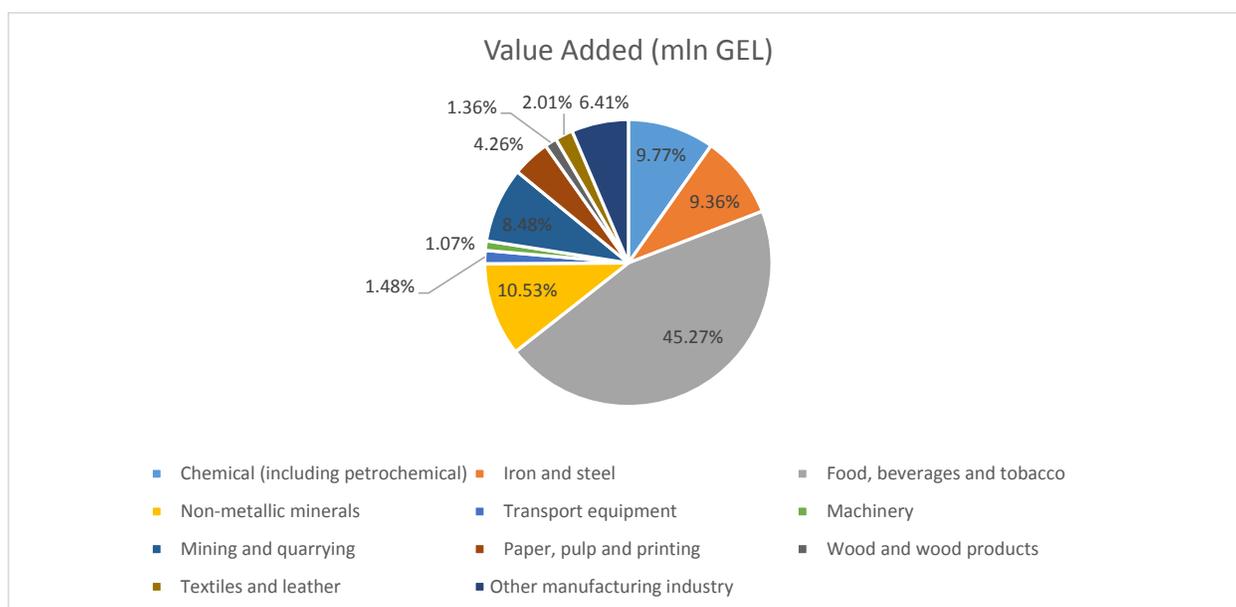
<sup>1</sup> Not covering construction sector

<sup>2</sup> An industrial enterprise of any legal form is considered to be large if an annual average number of employees is more than 100 individuals or annual turnover exceeds 1.5 mln GEL. If an industrial enterprise has 20-100 employees on average and turnover in the range of 0.5 mln-1.5 mln GEL annually, it is considered to be medium enterprise. If the enterprise has no more than 20 employees on average and turnover of no more than 0.5 mln GEL annually, it is considered to be small enterprise.

**Table I. Number of registered industrial enterprises by size and sub-sector**

Sub-sector	Large enterprises	Medium enterprises	Small enterprises	Total
Non-metallic minerals	67	82	559	708
Iron and steel	38	38	310	386
Machinery	13	29	272	314
Food, beverages and tobacco	226	217	1 875	2 318
Mining and quarrying	30	70	340	440
Transport equipment	7	1	12	20
Textiles and leather	17	24	303	344
Chemical and petrochemical	24	29	116	169
Paper, pulp and printing	33	60	448	541
Wood and wood products	9	15	134	158
Not elsewhere specified (industry)	72	96	1 118	1 286
<b>Total</b>	<b>536</b>	<b>661</b>	<b>5 487</b>	<b>6 684</b>

Among the subsectors covered in the energy balance, the construction sector has the highest production, while the food, beverages and tobacco subsector accounts for the biggest share of value added within the industry sector itself.



**Figure I. Distribution of value added shares among industry subsectors (construction sub-sector not included) in 2014**

In terms of energy consumption, HeidelbergCement Georgia, Rustavi Azot and Georgian Manganese are the largest industrial enterprises.

## 2 Legal Framework and Institutional Arrangement

The Georgian “Law on Entrepreneurs” regulates industrial entrepreneurship, mainly its administrative and legal issues rather than every type of business conduct. Georgian “Law on Control of Entrepreneurship” defines the norms to be applied by the state and self-governing units while controlling entrepreneurial activities.

Coordination of the policy for economic growth of Georgia (including industry sector), identification of the main directions of economic development and elaboration of corresponding programs are the tasks of the Department of Economic Growth and Planning at the Ministry of Economic and Sustainable Development. The Unit of Sustainable Development of the same Ministry is responsible for elaboration of the strategy for sustainable development and supporting state programs. They also coordinate the review and analysis of innovation projects and participate in preparation of legal initiatives supporting sustainable development.

In addition to that, the Unit of Research on Industrial and Service Sectors of the Ministry of Economy and Sustainable Development is responsible for identification and development of new economic activities in different sectors, including industry; to conduct research on different economic sectors and their development potential; and to identify barriers in the value chain of private sector and plan the actions to overcome these barriers.

The Ministry of Environment and Natural Resources Protection issues the environmental impact permit for industrial activities. The Law of Georgia on Environmental Impact Permit outlines a complete list of industrial activities that are subject to mandatory ecological expertise on the territory of Georgia. The same Law defines the legal basis for public participation and information in the process of issuing environment impact permit, conducting ecological expertise, environmental impact assessment and decision making regarding the permit.

The activities that are not subject to ecological expertise, are obliged to follow environmental technical regulations according to the Ordinance of the Government of Georgia N17 on “Approval of Environmental Technical Regulations” dated January 3, 2014.

According to Georgian “Law on Ambient Air Protection” and “Technical Regulations for Self-monitoring and Reporting of Emissions of Harmful Substances from Stationary Sources of Pollution” (Decree N413 of Georgian Government dated December 31, 2013), the Ministry of Environment and Natural Resources Protection conducts the registry of emissions of harmful substances from stationary sources of pollution. The report on such pollutants is conducted by enterprises according to the state registry form for emissions of harmful substances by February 15 of each year. The filled-in forms are submitted to be agreed with the Ministry of

Environment and Natural Resources Protection, more precisely to the Unit of Environmental Monitoring and its territorial units except for Adjara.

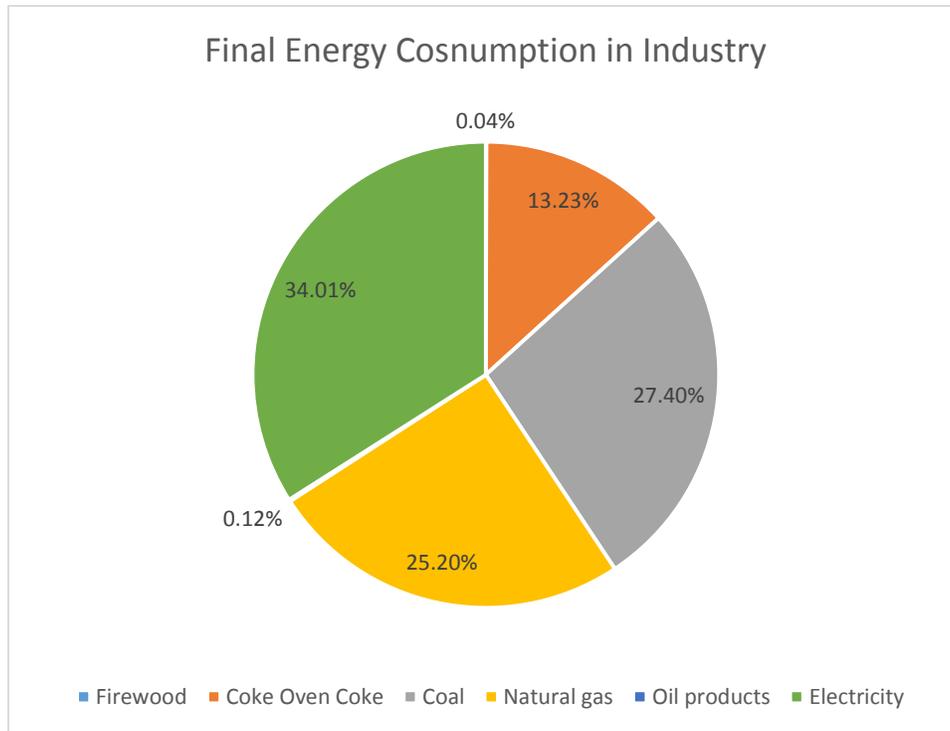
In case of Adjara, the enterprises submit the abovementioned state registry forms to the Department of Environment Protection and Natural Resources in order to report on the stationary sources of harmful substances polluting the air. Every physical person and legal entity (of any type of ownership and legal form) owning stationary sources emitting harmful substances is obliged to fill in the state registry form.

After February 15, the Environmental Monitoring Unit and the Department of Environment Protection and Natural Resources of Adjara submit agreed state registry forms to the Ministry of Environment and Natural Resources Protection of Georgia before March 1<sup>st</sup>.

From 2017 in order to simplify the reporting process by enterprises to the Ministry, an electronic system of reporting will be introduced. Accordingly, in 2017 an electronic registry form should be filled in online before February 15 on the following web site: [emoe.gov.ge](http://emoe.gov.ge) (the amendment on electronic reporting will be reflected in a corresponding law).

### **3 Energy Consumption and Greenhouse gas (GHG) Emissions in Industry Sector**

In 2014, in total 29.82 PJ of energy was consumed by the industry sector, which is 18.7% of the total energy consumed by Georgia. In industry sector, electricity is the most consumed energy carrier (34.01%), followed by coal (27.4%) and natural gas (25.2%). The consumption of coke is also high - 13.23%.



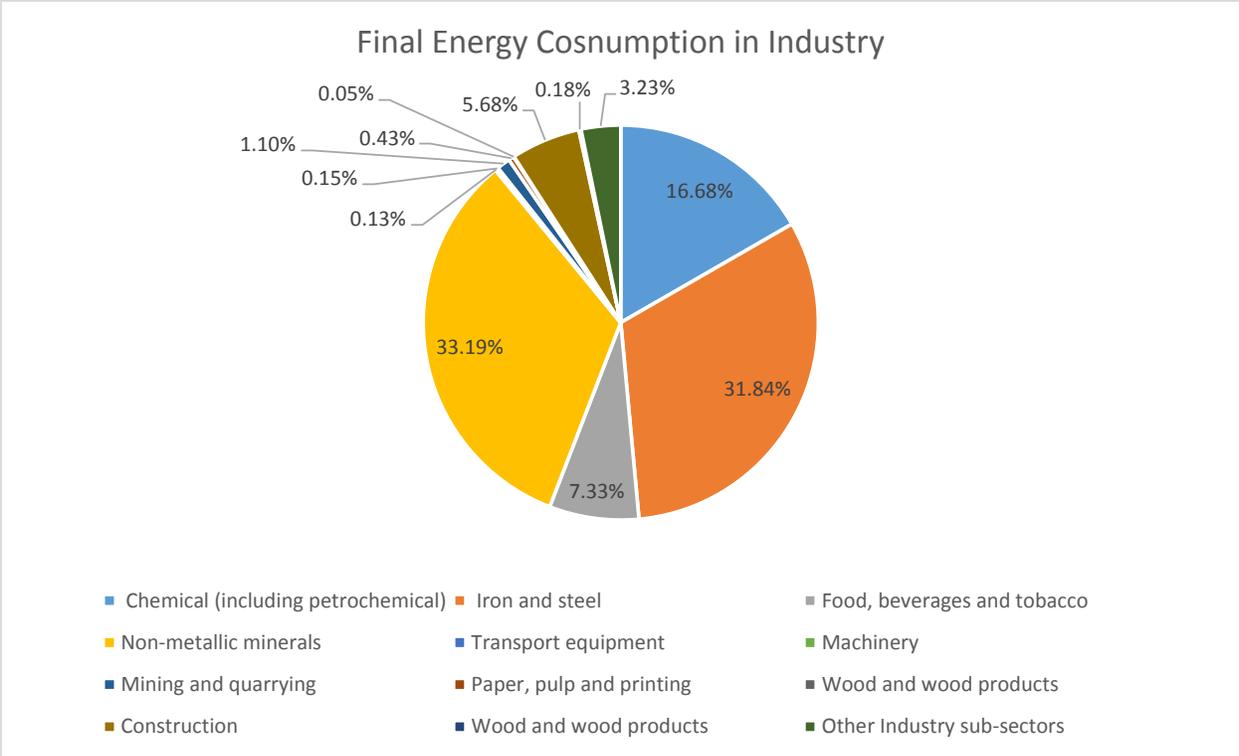
**Figure 2. Distribution of final energy consumption in energy sector by energy carriers - 2014.**

In 2014, in the industry sector the GHG emissions from fossil fuel combustion consisted 1 638 Gg CO<sub>2</sub> equivalent. In comparison with 1990 the emissions in 2014 decreased 6.42 times (in 1990 GHG emissions from industry sector were approximately 10 530 Gg CO<sub>2</sub> equivalent).

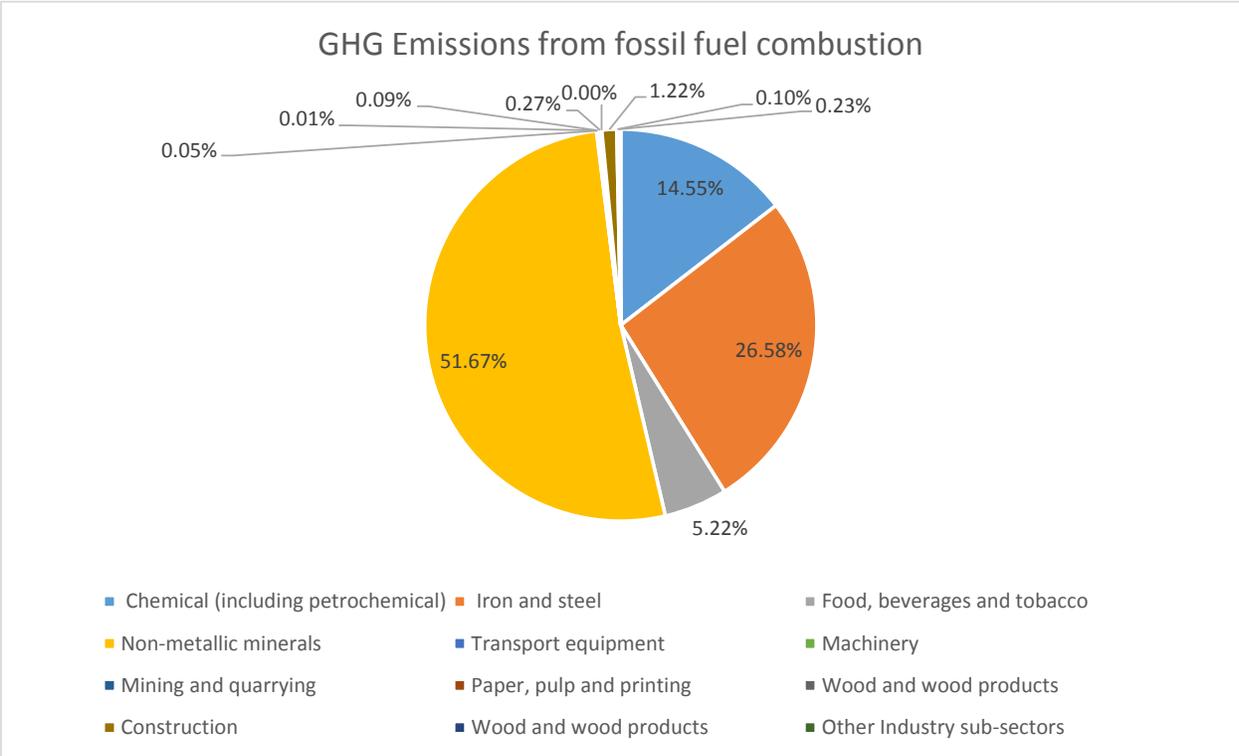
Among industry sectors that are registered in the energy balance of Georgia, the highest consumption of energy goes under the following four subsectors:

- Non-metallic minerals - 33.19%
- Chemical and petrochemical - 16.68%
- Iron and steel - 31.84%
- Food, beverages and tobacco - 7.33%

These subsectors together stand for 89% of total energy consumption and 98% of total GHG emissions from fossil fuels (94% if indirect emissions from electricity are also added) from industry sector.

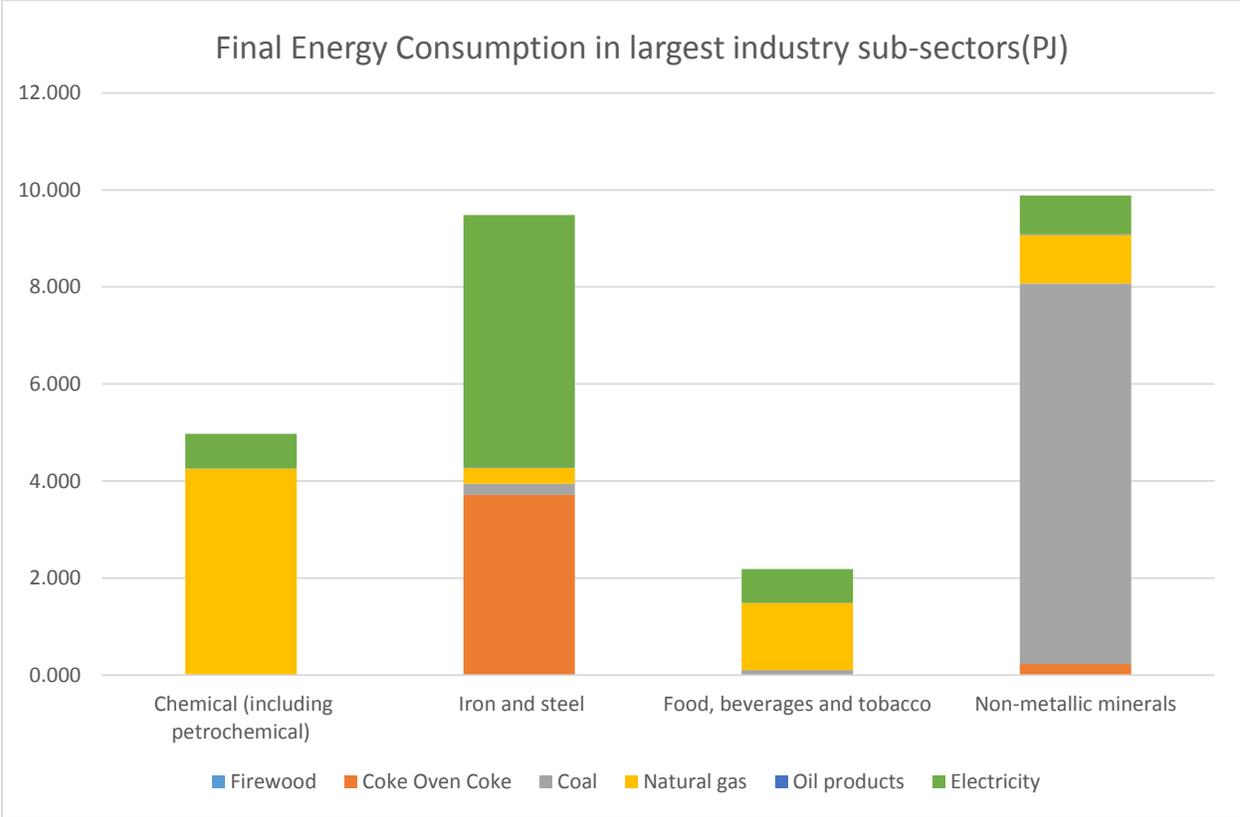


**Figure 3. Distribution of final energy consumption by industry subsectors -2014**

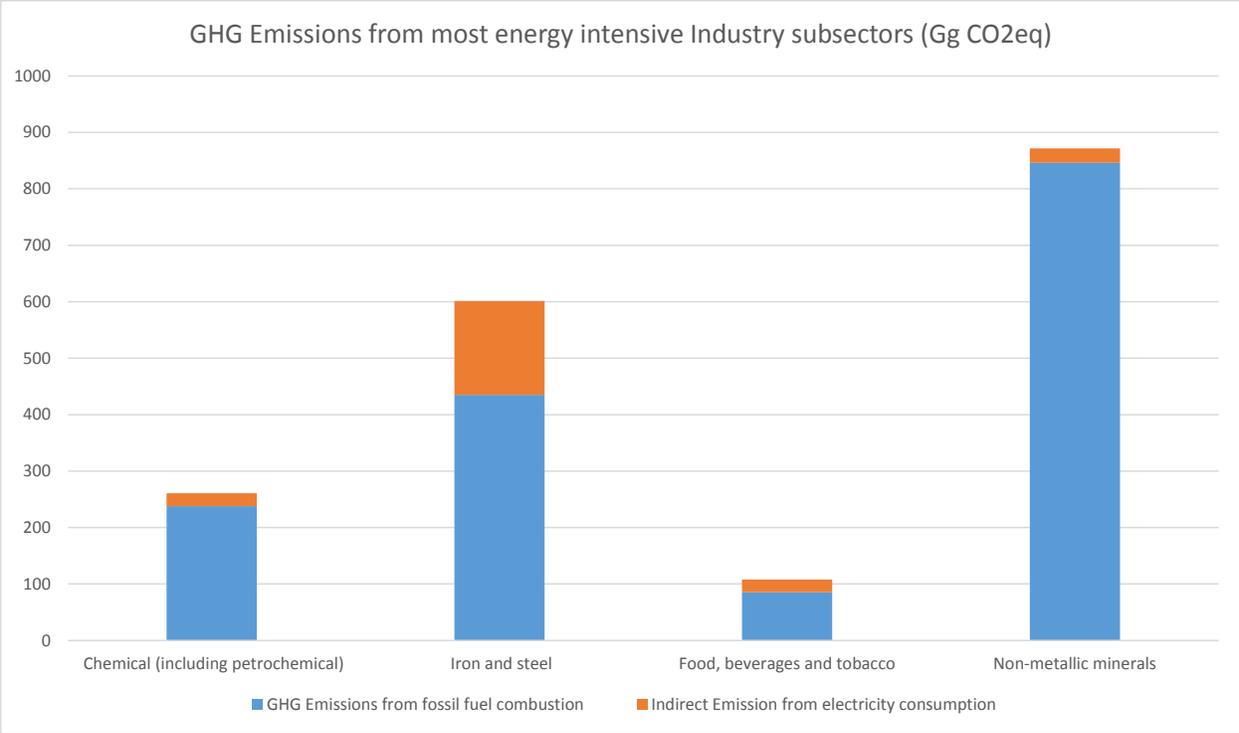


**Figure 4. Distribution of GHG emissions from fossil fuel combustion by industry sub-sectors -2014**

The Figures below present energy consumption by and GHG emissions from four the most energy-intensive industry sectors. The Figures show that the highest consumption of energy is in the iron and steel subsector, while the non-metallic minerals subsector is characterized by the highest emissions due to consumption of large amount of a coal.



**Figure 5. Energy consumption by the most energy-intensive subsectors of industry -2014**

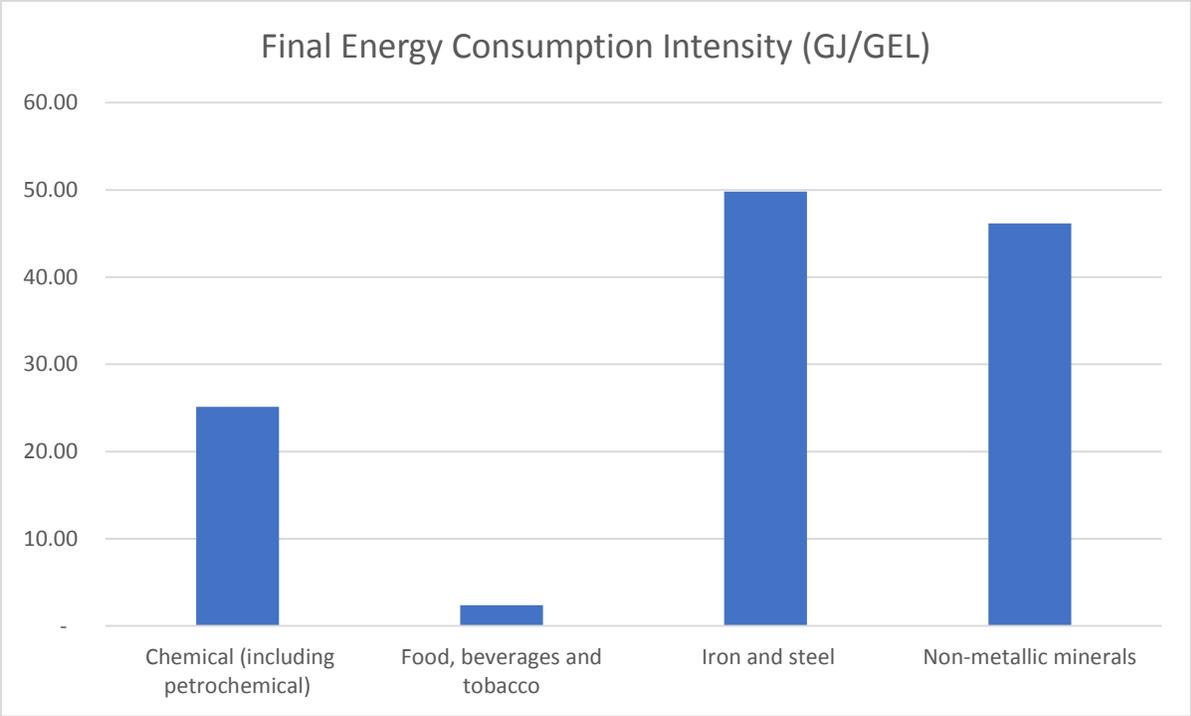


**Figure 6. GHG emissions from the most energy-intensive subsectors of industry -2014<sup>3</sup>**

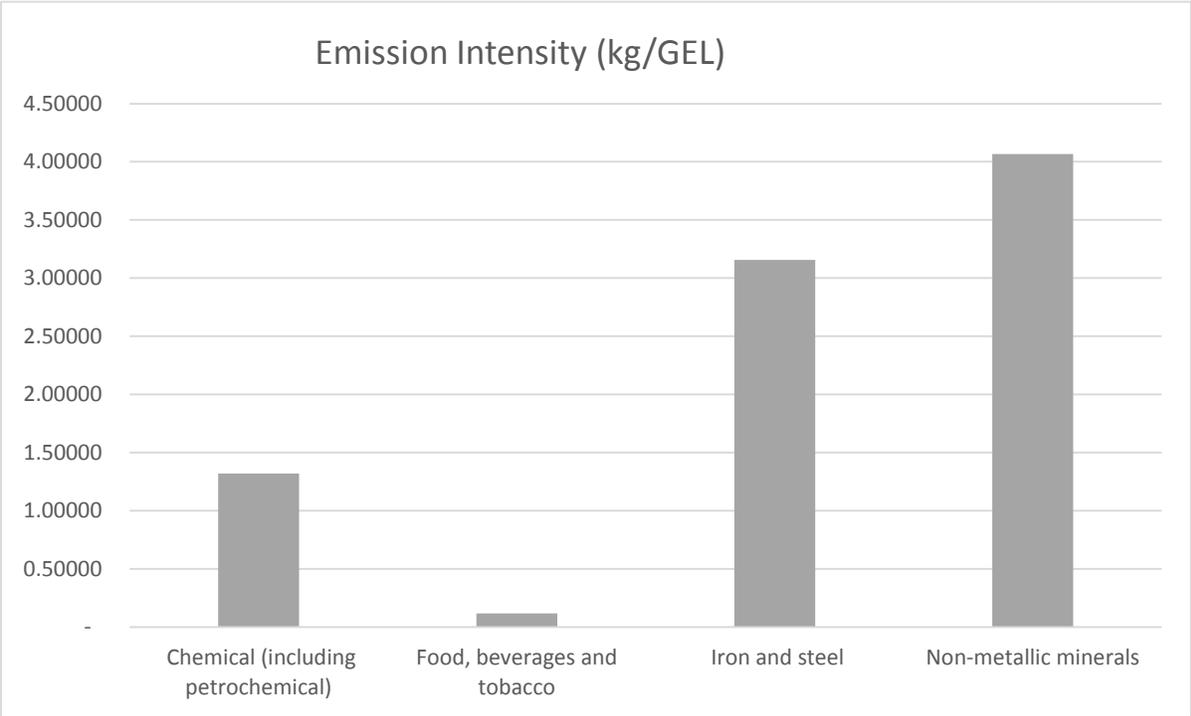
The most energy-intensive subsector per each GEL of the value added<sup>4</sup> is the iron and steel industry, which is on the other hand it is not highest emission-intensive subsector because the big portion of energy consumed in the iron and steel industry is electricity. Non-metallic minerals Industry is the most emission-intensive due to high consumption of coal.

<sup>3</sup> Indirect emissions from electricity consumption are calculated using average grid emission factor – 0.115 tons/MWh

<sup>4</sup> Value added is the component of GDP, which represents the sum of value added of all economic activities.



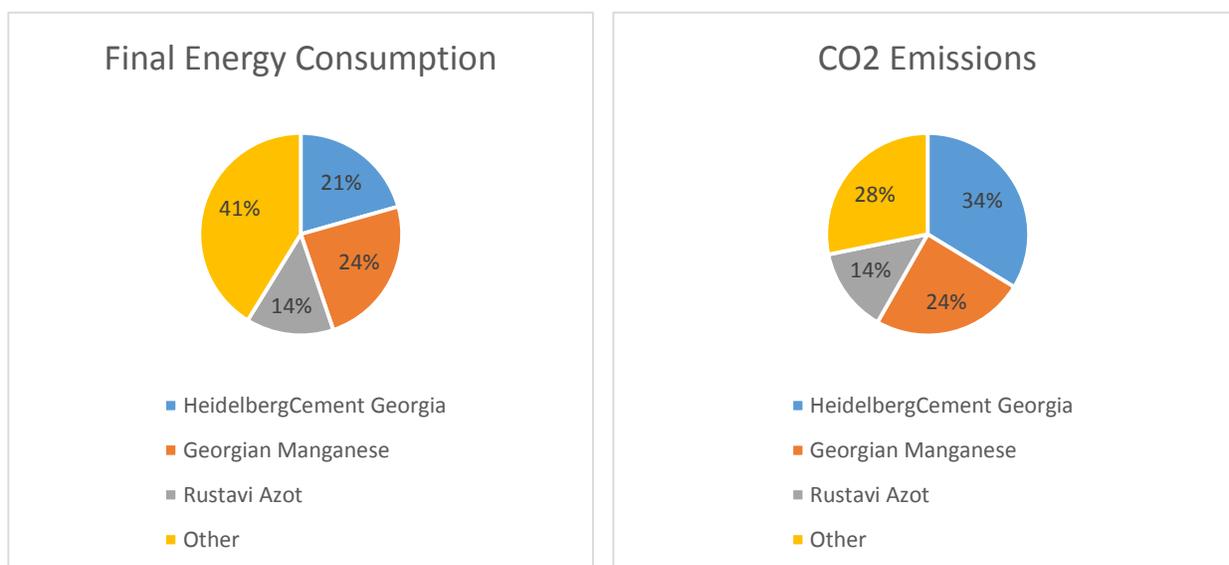
**Figure 7. Energy consumption intensity in energy-intensive subsectors of industry in 2014**



**Figure 8. Intensity of GHG emissions from fuel combustion in energy-intensive subsectors of industry in 2014**

In order to collect the information on industrial processes and applied technologies in four the most energy-intensive subsectors of industry, the EC-LEDS project interviewed large industrial plants with the support of the Ministry of economic and Sustainable Development. In total, 18 industrial plants were interviewed.

The results of the interviews showed, that three industrial plants are responsible for 71.8 % of the total GHG emissions from fuel combustion from an entire territory of Georgia. The same three industrial plants consume 58.8% of energy used by the industry sector in total.

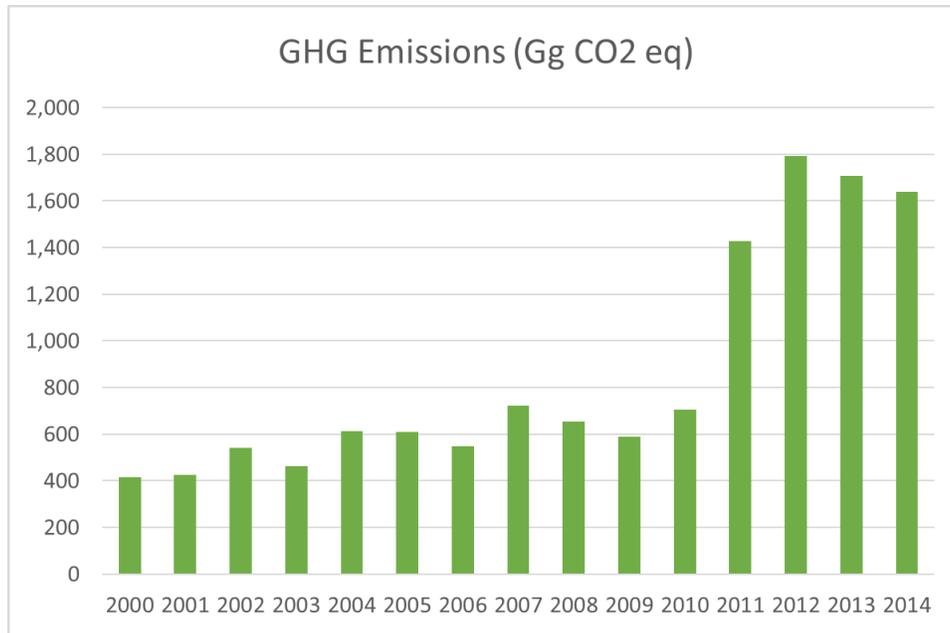


**Figure 9. Distribution of energy and CO2 emissions between the three largest and other industrial plants in Georgia in 2014**

#### 4 Trend of the GHG Emissions (from fossil fuel combustion) in Industry Sector

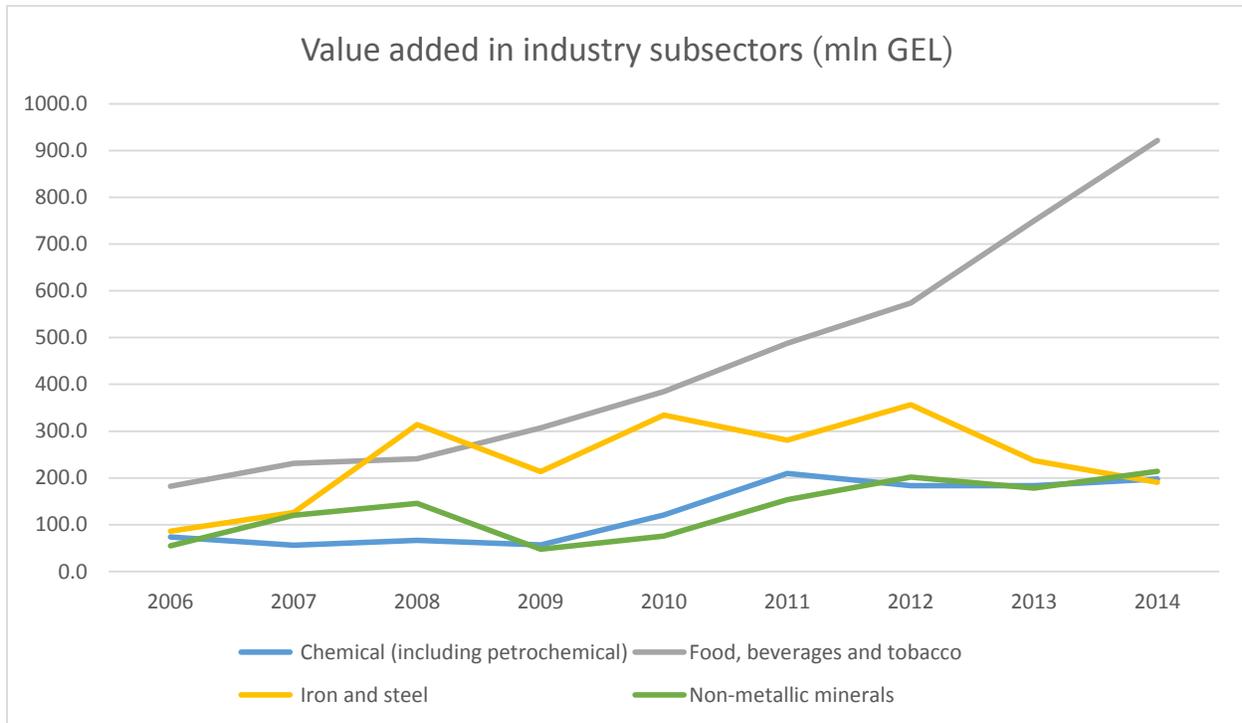
The Figure 10 shows the trend of GHG emissions from fossil fuel combustion in the industry sector.<sup>5</sup> Unfortunately, it is impossible to make any conclusion based on this trend since the latter is not reliable. Drastic increase of emissions in 2011 was caused by the correction of gas consumption in chemical industry for 2011-2014 performed during preparation of Georgia’s first Biennial Update Report (BUR). However, the trends for the previous years have not been corrected. In order to make accurate conclusions regarding the trend, the emissions from previous years also need to be recalculated using the IPCC recalculation methodology.

<sup>5</sup> Source: 2000-2009 - The Third National Communication, 2011-2013 - The First Biennial Update Report of Georgia, 2014 - calculations conducted by the experts of EC-LEDS project.



**Figure 10. Trend of the GHG emissions from fossil fuels combustion in industry sector**

Correlation between Total Final Energy Consumption and total value added in Industry is very high (0.96). It was not possible to do correlation analysis by sub-sector basis though, because there is no statistics on energy consumption in sub-sectors of industry before 2013. As for the increase of the value added, the highest increase is observed in the food, beverages and tobacco subsector. This was largely caused by prioritizing of agriculture and related food production sectors in the economic and social development strategy of Georgia (see the Chapter “Existing Strategic Objectives in Industry Sector). The value added produced by the chemical and petrochemical as well as non-metallic minerals subsectors stayed almost the same for the last two years, while the trend in iron and steel subsector has been decreasing.



**Figure 11. Trends of the volume of value added in industry subsectors in 2006-2014**

## 5 Analysis of Energy-intensive Enterprises in Georgia

This chapter presents the analysis of the results of the interviews with the industrial plants.

### Non-metallic minerals

Within non-metallic minerals subsector, four the most energy-intensive industrial enterprises were identified:

- Cement production
- Glass container production
- Burnt clay brick and block production from
- Lime production.

Correspondingly, the following enterprises were interviewed:

- Ltd. “HeidelbergCement Georgia” (clinker and cement production)
- JSC “Mina” (glass container production)
- JSC “Metekhis Keramika” (brick production)
- Ltd. “Industria Kiri” (Lime production).

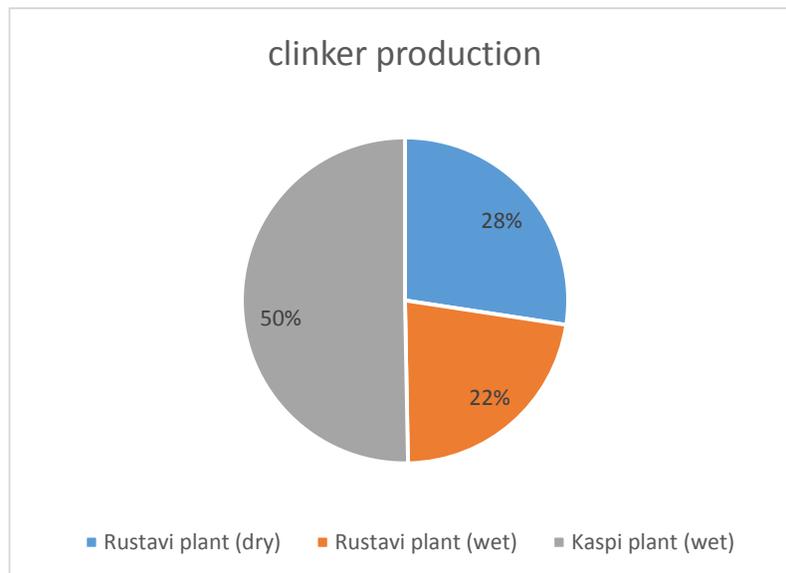
Above listed industrial enterprises are responsible for 80% of the total energy consumed within this subcategory.

### Cement and Clinker Production

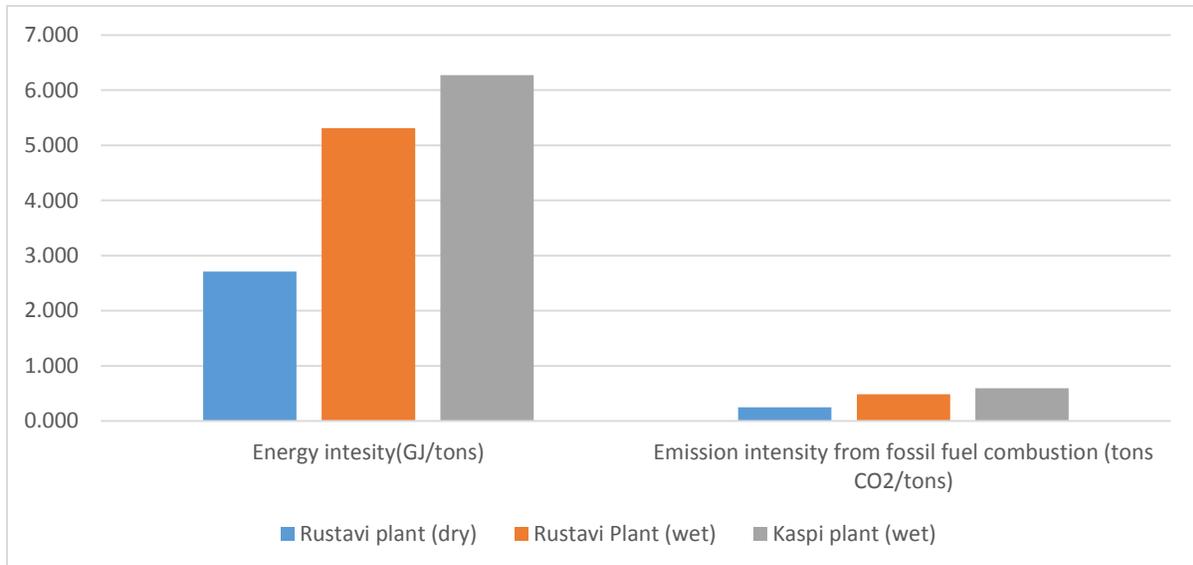
In 2014 HeidelbergCement Georgia Ltd produced 100% of clinker and 74.4% of cement produced in Georgia. In the same year, the industrial plants of HeidelbergCement consumed 7 188 TJ of energy that represents 72.2% of the energy consumed in non-metallic minerals subsector. 658 247 t of CO<sub>2</sub> emissions from fuel combustion (including indirect emissions of electricity) were emitted that represents 77.8% of emissions from the non-metallic minerals category in total.

The main source of emissions in cement production is clinker production because of the coal that is used during the production process. In 2014, HeidelbergCement produced 1 372 432 tons of clinker. In comparison with 2010 the production of clinker is increased by 24%.

There are three plants HeidelbergCement Georgia that produce clinker and cement. One is located in Kaspi and the other two in Rustavi. One plant located in Rustavi uses a dry method, the others a wet method of clinker production. The biggest portion of produced clinker is produced in the Kaspi plant and only 28% is produced by dry method in Rustavi.



**Figure 12. Distribution of clinker production by HeidelbergCement plants in 2014**



**Figure 13. Intensity of energy consumption per production of 1 tone of clinker in three plants of HeidelbergCement.**

In case of wet method production, the difference between Rustavi and Kaspi plants is caused by the difference in water content during the production of clinker suspension.

### **Lime Production**

In 2014, the Ltd. “Industria Kiri” produced 22 thousand tons of Lime that is 53.4% of the Lime produced in Georgia in total. Coal (imported anthracite) and electricity are used during the production process. The intensity of energy consumption is 4.48 GJ per ton of a product.

### **Brick Production**

In 2014 the JSC “Metekhi Keramika” produced approximately 10 million bricks. Natural gas and electricity are used during the production process. The intensity of energy consumption is 7.59 GJ per 1000 product units.

### **Iron and Steel**

The most energy-intensive production within the iron and steel subsector is ferroalloys production. The following four industrial enterprises active in ferroalloys production were interviewed:

- Ltd. “ Chiaturmanganese Georgia”
- Ltd. “Georgian Manganese”
- Ltd. “GTM Group”
- Ltd. “Rusmetali”.

Three enterprises producing the steel were interviewed as well. These enterprises are:

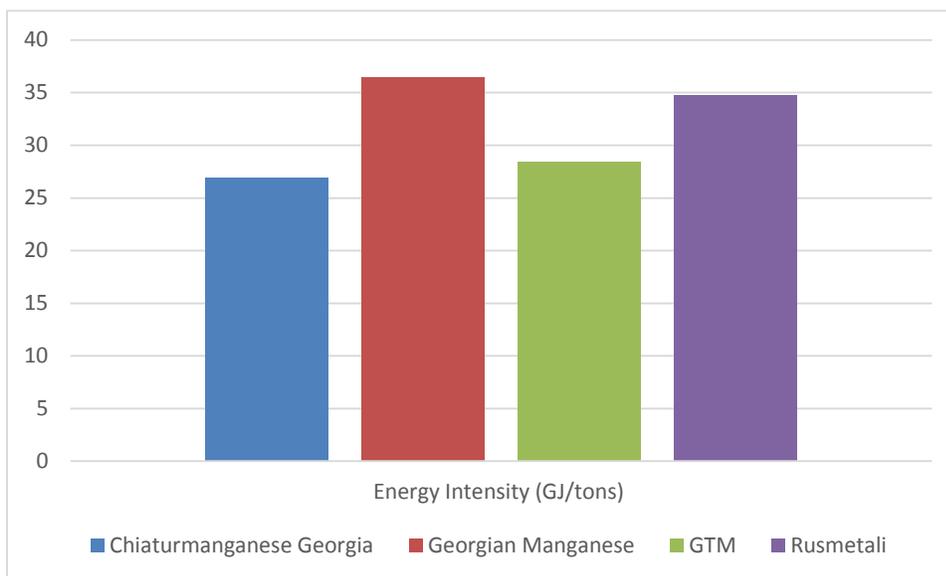
- Ltd. “Iberia Steel”
- Ltd. ‘Rustavi Steel’
- Ltd. ‘Geosteel’.

The enterprises interviewed are responsible for almost all fuel consumed by the “Iron and Steel” category in total.

### Ferroalloys Production

The ferroalloys production is one of the largest production lines in Georgia. The export of ferroalloys products from Georgia takes the 4<sup>th</sup> place in the index of exported products. Georgia mainly produces silico manganese. Four enterprises that were interviewed produced 213 thousand tons of silico manganese, 4.6 thousand tons of ferromanganese, and 9.8 thousand tons of ferrosilicomanganese and up to 2 thousand tons of ferrosilicon. Vacuum-arc furnaces that consume the electricity are used during the ferroalloys production. The coke is used as a reducing agent.

The intensity of coke as well as electricity consumption per ton of a product is different in each of four enterprises interviewed. Ltd. “Georgian Manganese” has the highest indicators - approximately 523-277 kg per ton of product coke consumption intensity and 4700-5400 MWh per ton of product electricity consumption intensity. Ltd. “Chiaturmanganum Georgia” has the lowest coke production intensity (330-340 kg per ton), while Ltd. “GMT Group” has the lowest electricity consumption intensity - 3600-4400 MWh per ton of product.



**Figure 14. Intensity of energy consumption during ferroalloys production (GJ/ton)**

It should be noted that the electricity consumed in “Georgian Manganese” is entirely produced and received from its own “Vartsikhe Hydro Power Plant”.

## **Steel and rebar production**

All industrial enterprises that were interviewed produce rebar that implies steel melting and rebar casting. Ltd. “Rustavi Steel” and Ltd. “Geosteel” reported also production of steel separately. In these plants, the steel is produced by means of melting scrap and metal slag in an electric arc furnace. The biggest portion (80%-85%) of the material is produced from scrap. Natural gas and coke are used as well. Natural gas is indirectly used for cutting of steel and drying of formworks. Coke is used to correct the level of carbon in steel. Ltd. “Iberia Steel” melts the grey metal scrap and produces different sorts of rolled stock products. Natural gas and electricity are used in the process.

The information reported by these plants in questionnaires was not enough for analysis of energy intensities in these plants for different products. To adequately compare energy intensity values for steel and rebar casting in these plants, additional analysis of energy consumption for each production process separately is required.

## **Chemical Production**

“Rustavi Azot” is the largest chemical industrial plant in Georgia. In 2014, “Rustavi Azot” produced 220 347 tons of ammonia, 393 074 tons of nitric acid, 491 671 tons of ammonium nitrate and relatively less amount of sodium cyanide, ammonium sulfate, liquid-gaseous-oxygen, dry ice and liquid carbon dioxide.

The most energy-intensive processes are ammonia production, followed by nitric acid production.

The plant uses both, the natural gas and electricity. In ammonia production the natural gas is used as a raw material and for energy purposes. 46% of natural gas consumed by “Rustavi Azot” in total is used for energy purposes. In this percentage, 21% is used for nitric acid and the rest for ammonia production.

In terms of energy-intensity of fuel consumption, the energy-intensity of ammonia and nitric acid production is 18.9 GJ and 2.3 GJ per ton of a product respectively.

## **Food, Beverages and Tobacco**

Five large enterprises were interviewed in this subcategory:

- Ltd. “Puri” (bread production)
- Ltd. ‘Georgian Industrial Asset Management Group” (juice production from fruits and vegetables)
- JSC “Tbilisi Tambaco” (tobacco products)

- Ltd. “Vim Bil Dan Georgia” (dairy products)
- Ltd. ‘Agaris Shaqris Kompania” (sugar production).

Ltd. “Agaris Shaqris Kompnaia” is the largest company among the ones listed above. In addition to sugar, it also produces Lime that is needed for sugar production. The company owns the thermal power station that provides electricity to the company.

One of the characteristics of the food, beverages and tobacco subcategory is the combination of multiple productions of different products and relatively even distribution of energy consumption. Therefore, it will be difficult to make the conclusions regarding the energy intensity of different products only based on the companies interviewed. Respectively, the aim of the interviews was not to define these parameters but rather to identify the ways for improvement of energy efficiency in these companies.

## **6 Existing Strategic Objectives in Industry Sector**

In recent years the Georgian economy has been increasing averagely by 5.6% annually. This increase happened due to reforms undertaken for liberalization of the economy. However, those reforms turned out to be insufficient for supporting the increase of production, competitiveness and long-term economic growth.

The industry sector has the smallest increase in production, while other sectors of the economy got enlarged. The level of industry development and its export potential is still low. Export is not diversified, its value added is low, and indicators of market penetration and establishment are still weak. In addition to that, the level of innovation is still unsatisfactory in the country and the state as well as private investments in the Research and Development (R&D) are low as it is reflected in different international reports and ratings. The main task of the socio-economic development strategy of Georgia (“Georgia 2020”) is to overcome the barriers that hinder the steady increase of productivity and competitiveness of private sector.

One of the important strategic directions of “Georgia 2020” is the increase of competitiveness of private sector. The following actions are defined to support the latter. In particular:

- Improvement of investment and business environment
  - Strengthening of property rights protection
  - Strengthening of mechanisms for effective solution of commercial disputes
  - Further elaboration of investment legal framework
  - Improvement of legal and institutional mechanisms supporting free competition
  - Improvement of mechanisms for insolvency and closing of a business
  - Improvement of tax system and further streamlining of administrative procedures

- Providing flexible regulation mechanisms
- Innovation and technologies
  - Increase the availability of finances for R&D and supporting the commercialization of the latter
  - Development of infrastructure for innovations
  - Strengthening the protection of intellectual property rights
  - Supporting a wide utilization of information and communication technologies in economy
  - Attracting direct foreign investments that are oriented towards modern technologies
- Supporting increase in export
  - Decrease of the technical barriers in trade
  - Supporting export of agriculture products
  - Creation of systems supporting export development
  - Further development of international trade relations.

Improvement of availability of finances is also prioritized in “Georgia 2020”. Nowadays there are two main obstacles in this regard: firstly, the country’s economy cannot produce enough internal resources for investments and secondly, inadequately developed financial institutions cannot provide effective financial intermediation. According to the report of 2013-2014 on global competitiveness, Georgian companies named limited availability of finances as one of the most important barriers for business development. To overcome this barrier, the following directions are considered in “Georgia 2020”:

- Mobilization of investment resources
  - Fiscal policy oriented on savings
  - Establishment of deposit insurance
  - Pension reform
  - Foreign investments
  - Encouragement of long-term investment resources
  - Increased volume of long-term loans issued and deposits conducted in GEL (Larization)
- Supporting the development of financial intermediation
  - Supporting development of stock market
  - Encouragement of non-banking institutional investors
  - Supporting venture capital
  - Financing small and medium business enterprises by micro financial organizations
  - Increase availability of finances for small, medium and start-up businesses
  - Supporting availability of investment resources for agriculture.

## 7 Main Barriers and Challenges for Low-Emission Development in Industry Sector

In order to implement low-emission measures in industry sector of Georgia, the following important barriers and challenges should be taken into consideration that hinder the process of low-emission strategy development and implementation:

- ***Lack of consideration of low-emission development in strategic planning of economic development***

Low emission development and environmental protection in general are not the yet in top priorities of country's development put into practice, although formally are considered as such. According to socio-economic development strategy of Georgia (Georgia 2020), the Government of Georgia aims at implementation of such economic policy that ensures sustainable development of the country. Despite the fact, that the term "sustainable development" is often used and referred to, none of the strategic directions listed above prioritizes sustainable and low-emission development (except for innovations and technologies development). The main principle of the economic development strategy of the country is to ensure a free environment for business development and less bureaucratic burden that in many cases imply environmental regulations as well. In addition to that, often the governing bodies of the country consider low-emission development as a hindering factor of economic development and such thinking negatively effects the strategic decision-making process.

- ***Lack of free financial capital.***

The implementation of energy efficient measures in industry sector requires a considerable investment capital. It is challenging for industrial companies to attract this capital. This is true especially in Georgia where there is a lack of investment capital in general. "Georgia 2020" identifies a number of strategic measures to support the improvement of availability of finances (see the Chapter "Existing Strategic Objectives in Industry Sector"). Although, the support of small and medium enterprises, as well as foreign investments are prioritized, and the strategy does not consider the support of investment in energy efficiency and renewable energy technologies, which require considerable additional capital.

- ***Lack of energy efficient technologies and qualified professionals.***

During the interviews of the companies, it became obvious that they fall into two different groups – 1) the companies such as HeidelbergCement and Rustavi Azot know how to decrease energy consumption in their respective industrial plants, however face lack of investment capital as the main barrier and 2) the companies that does not have knowledge and access to the

measures/technologies that can decrease energy consumption and therefore, need support in this direction.

- ***Low level of general awareness.***

The interviews of the industry companies revealed that in many cases the level of awareness about energy efficient measures is quite low. There is no understanding of such measures as the possibility for the cost reduction, rather they are considered as additional cost.